luminal area (MLA) ≤4mm2, non-calcified VH-defined thin cap fibroatheroma (ncVHTCFA)).
Results: 3,674mm of VH-IVUS pullback were studied. Stented plaque necrotic core area was higher in ACS patients (25% [18-28] vs. 19% [14-26], p=0.04). None of the higher risk VH-IVUS features (PB≥70%, MLA≤4mm2, ncVHTCFA) were more prevalent in ACS. Whole vessel and whole plaque Stress-P1 was similar between groups. In contrast, Stress-P1 was increased in ACS patients where MLA≤4mm2 (8.24 [7.06-9.93] vs. 7.72 [6.33-9.34], p=0.03), PB≥70% (9.18 [7.44-10.88] vs. 7.93 [6.16-9.46], p=0.02) and ncVHTCFA (9.23 [7.33-11.44] vs. 7.65 [6.45-8.62], p=0.02), and markedly increased for combinations (e.g. MLA≤4mm2 and PB≥70% (8.94 [7.23-10.70] vs. 7.74 [6.13-9.01] p=0.009) and MLA≤4mm2 and ncVHTCFA (8.73 [7.32-10.91] vs. 6.40 [5.83-7.53] p=0.004)). There was a positive correlation between increasing luminal area and Stress-P1 (r=0.39, p<0.0001), but not with plaque burden (r=-0.03, p=0.11). Stress-P1 increased the discriminatory power of ncVHTCFA to predict ACS (area under the curve 0.558 vs. 0.717, p<0.0001).
Conclusions: Higher-risk plaque features defined by VH-IVUS are associated with increased maximum Stress-P1 in ACS patients. Elevated plaque stress may determine whether a higher-risk plaque ruptures, and biomechanical modeling may increase the ability of VH-IVUS to predict plaque rupture.

TCT-647

Co-registration of Intravascular Ultrasound and Angiography

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Background: Intravascular ultrasound (IVUS) provides cross sectional imaging of coronaries but lacks overview of the vascular territory provided by angiography. We studied the feasibility of automated co-registration of angiography and IVUS to facilitate interrogation of the two imaging modalities in a synchronous manner.
Methods: 49 consecutive patients undergoing surveillance for cardiac allograft vasculopathy with angiography and IVUS of the left anterior descending artery (LAD) were enrolled. A pre-IVUS angiogram of the LAD was performed followed by an ECG triggered fluoroscopy (ECGTF) during IVUS pullback (Eagle Eye Platinum - Volcano Corp.) at 0.5mm/s using an automatic pullback device. ECGTF was used to track the IVUS catheter during pullback and establish a spatial relationship to the pre-IVUS angiogram. Angio-IVUS co-registration was performed with a research prototype (Siemens Healthcare, Germany) and accuracy evaluated by distance mismatch between angiography and IVUS images at vessel bifurcations (Figure A).
Results: The median (IQR) co-registration distance mismatch measured at 108 bifurcations in 42 (85%) patients was 0.35 (0.00-1.16) mm (Figure B). 7 patients were excluded due to inappropriate data acquisition (n=3) and failure of tracking (n=4), e.g. due to overlapping sternal wires. Estimated effective radiation dose for ECGTF was 0.09mSv.
Conclusions: This study demonstrates the feasibility of angio-IVUS co-registration which may be used as a clinical tool for localizing IVUS cross sections along an angiographic roadmap.
Supporting File(s): Location: https://ww5.aievolution.com/tct2013/files/content/abstracts/abs_1794/pic_for_pub.jpeg

TCT-648

Coronary Atheroma Composition Predicts Endothelial Dysfunction in Non-ST Segment Myocardial Infarction: Novel Insights with Radiofrequency (iMAP) Intravascular Ultrasonography (IVUS)

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Background: Coronary atheroma composition and endothelial dysfunction are each known to associate with incident coronary events, yet little is known about their relationship in vivo. We tested the hypothesis that the degree of segmental epicardial vasoreactivity relates to the composition of underlying atheroma.
Methods: In 23 NSTEMI patients referred for coronary angiography, a non-culprit vessel underwent intracoronary salbutamol (0.30 mcg/min, 5 mins) provocation during automated IVUS pullback. A 40 MHz IVUS catheter delivered radiofrequency signals at constant 67micron intervals via a custom-built IVUS console (iMAP, iLAB, Boston Scientific). Macrovascular response [change in segmental lumen volume (SLV) at baseline and following salbutamol], percent atheroma volume (PAV) and tissue composition was evaluated in 187 contiguous non-overlapping 5mm coronary segments.
Results: Compared with segments that dilated (Δ in SLV >0), constrictive segments (Δ in SLV ≤0) showed similar lumen, but greater vessel volumes and PAV at baseline (Table). The extent of necrotic and lipidic plaque was significantly greater in constrictive segments, whereas fibrotic plaque content was significantly greater in segments that dilated. Calcific plaque content did not relate to endothelium-dependent vasoreactivity. The change in SLV correlated inversely with the amount of lipidic and necrotic plaque (both r = -0.23, p=0.002), and directly with fibrotic plaque content (r= 0.20, p=0.009). In a multivariable model, the extent of both lipidic and necrotic plaque independently associated with segmental vasoconstriction (β =1.2, p=0.023; β =0.66, p=0.027).
Conclusions: Following NSTEMI, both lipidic and necrotic plaque content each associate with segmental endothelial dysfunction, providing a mechanistic link between atheroma composition and lumen reactivity, and thus potential 'vulnerability' for a clinical event.

Parameter	All segments N = 187	Change in SLV Constriction N = 78	Dilation N = 109	P-value
Baseline SLV (mm^3)	38.9±14.9	40.7±1.7	37.5±1.4	0.15
PAV (%)	40.2±12.0	42.5±1.4	38.6±1.1	0.029
EEM (mm^3)	66.3±23.1	72.5±2.6	61.9±2.2	0.002
Necrotic (%)	16.4±10.3	18.3±1.2	14.9±0.98	0.029
Fibrotic (%)	73.5±13.4	71.0±1.6	75.6±1.3	0.026
Lipidic (%)	8.5±4.0	9.2±0.45	7.9±0.37	0.039
Calcific (%)	1.5±1.8	1.5±0.21	1.58±0.18	0.72

TCT-649

Impact of visit-to-visit variability of blood pressure and coronary atheroma changes by 3-D IVUS and subsequent cardiovascular events

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Background: Visit-to-visit variability in systolic blood pressure (SBP) was reported to be associated with increased cardiovascular risk. Intravascular ultrasound (IVUS) is used as an end point in studies aimed at reducing progression or regression of coronary atheroma. However, the relationship between variability in blood pressure and atheroma volume changes by IVUS, or long-term clinical outcomes has been poorly defined.
Methods: Serial IVUS examinations were performed in 338 stable angina pectoris patients undergoing percutaneous coronary intervention (PCI). After PCI for culprit lesions, intravascular ultrasound (IVUS) was performed in their non-culprit vessels to determine atheroma volume at baseline. After 12-16 months, IVUS of the originally examined coronary artery was performed during follow-up angiography. Five-year clinical outcomes, including major adverse cardio- and cerebrovascular events (MACCE), and annual progression rate of atherosclerosis by volumetric IVUS, and visit-to-visit variability in SBP for five-years were evaluated.
Results: Atheroma volume increase by IVUS was 5.7%, and five-years MACCE rate was 22.6%. Patients with MACCE had larger annual atheroma progression than the rest of the population (20.6% vs. 2.3%, P<0.001). Visit-to-visit variability in SBP was a strong predictor of subsequent increased coronary atheroma volume (eg., top-decile hazard ratio (HR) for SD SBP over five visits: 4.18, 95% CI 1.95–6.87, p<0.01), independent of mean SBP, but dependent on precision of measurement (top-decile HR over five visits: 4.21, 2.58–7.64, p<0.01). Maximum SBP reached was also a strong predictor of MACCE (HR for top- decile over five visits: 8.12, 3.46–10.11, p<0.01, after adjustment for mean SBP). In addition, residual visit-to-visit variability in SBP on treatment was also a strong predictor of increased coronary atheroma volume and MACCE (top-decile HR for MACCE: 4.49, 1.92–6.48, p<0.01).
Conclusions: Visit-to-visit variability in SBP and maximum SBP are strong predictors of increased coronary atheroma volume, independent of mean SBP. Increased residual variability in SBP in patients with treated hypertension is associated with a high risk of subsequent cardiovascular events.

TCT-650

The high sensitive C-reactive protein (hs-CRP) level represents the disease burden and the age but not vulnerability of coronary atherosclerosis: a study of volumetric plaque composition by 3-vessel virtual histology-intravascular ultrasound

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Background: hs-CRP has been known as a systemic inflammatory marker of atherosclerosis and considered as one of the predictors of future cardiac events. Some reports presented hs-CRP level was associated with plaque vulnerability but most studies were performed by assessing focal target plaque but not whole plaques from a coronary tree.
Methods: To evaluate of the relationship of plasma hs-CRP level and volumetric plaque composition of the coronary arterial tree, we performed 'whole vessel" virtual histology-intravascular ultrasound (VH-IVUS) in 189 vessels of 63 patients.The components of atherosclerosis were classified as fibrous (FI), fibrous-fatty (FF),

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